

Senior Management survey, October 2012

Survey highlights ^{p16}/Growing demand for energy ^{p18}/Securing energy through global co-operation ^{p22}/New kid on the block ^{p25}/Innovation: The game changer ^{p28}/Future of petroleum refining: Challenges and opportunities ^{p30}/Moving towards a gas era ^{p33}/Environment, health and safety ^{p36}/Renewable energy ^{p39}/Research methodology ^{p42}

Fuel for thought



***Hydrocarbon and beyond:
Changing Landscape***

This theme survey is published by Petrotech Society with PwC as knowledge partner on the occasion of Petrotech 2012, latest in the series of Conference & Exhibition events held in India that provide context around issues affecting the technology in oil and gas sector.



Message



S. Jaipal Reddy
Hon'ble Minister of Petroleum &
Natural Gas
Government of India
&
Patron-in-Chief, Petrotech 2012

India being a net importer of crude oil and natural gas is subject to the vagaries of the global oil & gas markets. The developments in the hydrocarbon space have increased the challenges faced by the players in this sector. The political unrest and economic sanctions in some countries that were major exporters of crude to India have furthered the problems for Indian oil & gas companies. The fluctuation of oil prices in the global markets has been a cause of concern for the country.

Petrotech conferences have been able to unite upstream, midstream and downstream sectors of the Oil & Gas value chain in their quest for securing adequate energy for the country. It has emerged as a coveted forum for the global hydrocarbon industry by lending thoughts to various dimensions of the sector. Petrotech Society has played an active role in bringing forth the key challenges being faced by various stakeholders in the Indian Oil & Gas Industry. I would like to congratulate them for the good work done thus far.

This background publication for Petrotech 2012 is another example of the good work done by Petrotech Society. I would like to thank Petrotech Society for bringing forth the thoughts of industry leaders on the way to perceive India's hydrocarbon sector to shape up. Such thought provoking publications provide insights into the challenges that Oil & Gas companies envisage in the long term. The views presented will go a long way in creating new policies and regulations and help modifying existing policies so that they remain relevant in the future. I would urge Petrotech Society to continue the good work so that we are able to achieve the common objective of being an energy secure country in the years to come.

S. Jaipal Reddy



Message



R.P.N. Singh

Hon'ble Minister of State
Petroleum & Natural Gas
Government of India
&
Patron, Petrotech 2012

I am happy that the 10th International Oil & Gas Conference and Exhibition - Petrotech-2012 from 14th – 17th October, 2012 is being organized by Indian Oil under the aegis of this Ministry.

I am told that like previous years, Petrotech Society will be publishing a book on the theme “Hydrocarbon and Beyond: Changing Landscape” on the occasion of Petrotech-2012.

In the past, Petrotech conferences have been able to bring to the table various interesting topics of discussion. It has been a forum where developments in the hydrocarbon sector around the globe have been brought forward. Petrotech Society has continuously collaborated with the stakeholders to bring to the forefront various issues being faced by them. They have excelled in the task of bringing the bearer of industry's views.

I believe that Petrotech-2012 will be as engaging and thought provoking as the previous Petrotech conferences. The background publication for Petrotech-2012 has brought to forefront the challenges that the industry players foresee in the years to come. Petrotech Society deserves a special mention for its ability to provide such insights time and again. Such publications also provide indicators to Ministry of Petroleum & Natural Gas on the manner in which industry expects it to develop policies and regulations enabling the growth of the sector. I would like to thank Petrotech Society for bringing forth the views of the industry yet again. I would urge them to continue the good work and develop insightful publications on the emerging issues in the sector.

R.P.N. Singh



Message



G.C. Chaturvedi
Secretary, Ministry of Petroleum &
Natural Gas
Government of India
&
Conference Chairman, Petrotech 2012

Hydrocarbon sector is the key to ensuring energy security in the country. It is the second source servicing India's energy needs. Ensuring energy security for a large nation like India is a huge challenge. It is therefore important that India continues developing its hydrocarbon sector.

India is a net importer of crude oil. Since 2008, crude oil prices have witnessed huge fluctuations. With the prices having touched the \$ 140/bbl mark and \$ 40 mark within a span of one year, oil companies in upstream, midstream and downstream sectors are increasingly facing the challenge of having a view on oil price movements even in the short-term. The rupee depreciation in the last few months has added to the challenges faced by refineries. Refining as a sub-sector has developed in India and we have now become a net exporter of petroleum products. Three new refineries in Paradip, Haldia and Cuddalore expected to be commissioned in the 12th Plan period along with the recently commissioned refineries in Bina and Bhatinda will further strengthen India's position as a refining hub in the region.

The recent developments have forced the players in the Indian Oil & Gas Industry to think beyond their comfort areas. Economic sanctions and political unrest in some of major oil exporting countries have become additional hurdles on India's path of achieving sufficient supply of hydrocarbons. Planning for long-term growth has thus become crucial for companies operating in the sector. Ministry of Petroleum & Natural Gas has always considered the industry players to be one of the most important stakeholders in the energy sector.

Petrotech Society has continuously collaborated with various stakeholders in the oil & gas value chain to bring to the forefront various challenges, issues and concerns being faced by them. Through various initiatives, they have been able to bring out the views of industry.

I believe that Petrotech 2012 will build upon the previous Petrotech conferences and will be useful for all participants. The event will be able to showcase the strength and might of Indian oil & gas industry. The background publication for Petrotech 2012 has brought out the trends in the sector that the industry players foresee in the years to come. These publications require immense dedication on the part of the organizers and I appreciate the efforts made. I thank Petrotech Society for bringing out this publication and presenting the views of the industry players. I hope that the good work will continue in the future and we will continue receiving such thought-provoking publications from the Petrotech Society.

G.C. Chaturvedi

Message



Sudhir Vasudeva
Chairman, Petrotech Society

Sample this gem from funny-man David Letterman:

USA Today has come out with a new survey - apparently, three out of every four people make up 75% of the population.

Aside from this lighter side of surveys, they do serve the purpose of collating and analysing the opinion of stakeholders and accumulating them into neat segments. What we do with this information subsequently is entirely our business.

Most are intrinsically conditioned to accept the majority view, especially, if they have no particular position on the subject and prefer to go along with the 'herd'. Others with strong views may find strength in the minority; though low in numbers, it nevertheless represents a substantial group of like-minded people. The power of surveys to swing opinion of the undecided is also pertinent as it represents clear choices to these 'fence-sitters' to now take a considered position. Surveys therefore represent processed 'information' that could be used selectively by stakeholders.

PETROTECH Society is partnering PwC to bring to our attention a survey of senior professionals of the Indian hydrocarbon sector on issues emanating from the theme of PETROTECH – 2012 : Hydrocarbons and Beyond – Changing Landscape. Results of this study could be potentially useful in defining direction and extent of engagement on a host of issues such as policy, investment, technology induction, tax regimes, strategic partnerships and regulation. It will also enable us to bring a somewhat sharper focus to the 'beyond hydrocarbon' aspect of the theme and will provide guidance on the extent of engagement that is desirable for core hydrocarbon sector companies toward investing in new and renewable energy resources.

The survey is expected to function as a compass for professionals and policy makers to help India chart a long-term strategic vision for energy security for this Nation. I am sanguine that it will be yet another aid in helping us move forward with direction and purpose.

A handwritten signature in black ink, appearing to read 'Sudhir Vasudeva', with a stylized flourish at the end.

Sudhir Vasudeva

Message



R.S. Butola,
Chairman, Steering Committee
Petrotech 2012

It gives me great pleasure to be associated with this year's PETROTECH Conference slated to be held in New Delhi, during October 14-17, 2012.

This year's theme, "*Hydrocarbon and Beyond: Changing Landscape*" is fascinating in many ways, silently reflecting upon the opportunities and challenges being faced by the human race as a whole. First, it instigates the policy makers and the elites of the hydrocarbon industry to think of alternatives – from the perspective of depleting hydrocarbon reserves and more importantly, from the perspective of limiting further harm to the environment. Then, in achieving so, it highlights the bigger challenge – how to provide energy to around 20% of the global population who have no access to electricity in an affordable manner. Thirdly, the theme also echoes the UN's objective of declaring the year 2012 as the "International year of Sustainable Energy for All".

"Hydrocarbon and beyond" instantly takes our thought process to sustainable development. Sustainability deserves a special mention in 2012 as at recently held Rio+20 conference, the global community completed a 20 year follow up to the 1992 Earth Summit that in many ways set the course of contemporary sustainable development. United Nations Environment Program (UNEP) itself attained the age of 40 in 2012 after being one of the key outcomes of the Stockholm Conference on Human Development, held in 1972.

Hydrocarbon energies are at the center of today's consumer-driven technology revolution. As per IEA's World Energy Outlook 2011, the share of fossil fuels (coal, oil and gas taken together) in the global primary energy basket stood at 81% in 2009. Energy consumption is projected to rise at a CAGR of 1.3% in its new policies scenario through 2035. Even though, the contribution of fossil fuels is projected to progressively come down, yet around three-fourths of the world energy would continue to come from fossil fuels, even in 2035.

Economic expansion in the developing world has triggered soaring energy demand. For example, in India, the scenario is a little different from that as explained above. Fossil fuels, which constituted 73% of the country's total energy supply in 2009, are likely to go up to 77% by 2035. The rise in fossil fuels consumption is mainly because of increased demand for energy with the growth in the GDP and also country's reliance on coal as one of the major source. On the back of rising demand, India surpassed Russia in 2009 to become the world's third-largest energy consumer, only after the U.S. and China, yet around 25% of its population still does not have access to electricity. India's per capita energy consumption is about one-fourth to that of China and about one-fifteenth to that of the U.S. Therefore, the need of the hour is to enhance the energy availability at a rapid pace so that aspirations of those who aspire to improve their standard of living with the growth taking place in the country, are fulfilled and reasonable access is provided to them.


Similarly, projected dipping of average global contribution of fossil fuels by 6-7% through 2035 is significant in itself, but the international goal of limiting the long-term average global temperature to 2°C above pre-industrialization levels becomes that much more difficult and challenging. This is obviously disturbing. The need, therefore, is to lay sustained and dedicated focus on developing and finding new technologies that will empower us to use the existing energy resources more efficiently and in an environment-friendly manner, as well as look for new resources that will share our dependence on hydrocarbons.

Of late, various organizations across the globe led by UN have been deliberating on the limitations of Gross Domestic Product (GDP) as a true indicator of economic transactions and activity. It is silent in many dimensions on human well-being and social equity, which are also considered important while assessing the needs of today's complex world. The new indicator that can assist in the construction of a more inclusive and wide-ranging indicator are the 'Human Development Index'; ILO's 'Decent Work indicator' and the UN 'System of Integrated Environmental-Economic Accounting'. It is pertinent to mention that in 2012 that the United Nations Statistical Commission has adopted the System of Integrated Environmental and Economic Accounting (SEEA) as a statistical standard in an effort to strengthen the system of national accounts of the countries.

Supply of more and more of clean energy to all is essential for nurturing inclusive growth and raising human development index. This has to be achieved in an efficient, economically viable and environmentally sustainable manner and to realize these goals all forms of energy – conventional, non-conventional as well as new and emerging resources need to be explored.

India is blessed with an abundance of sunlight, windy sites, water and biomass. A series of initiatives have been taken to exploit these natural resources without causing damage to our mother earth. There is need to pursue them with added fervor besides looking into other alternate sources where focused R&D work will have to be carried out. Value addition to lignin is very important to improve the economics of 2nd generation bio-fuels from Bio-mass. This is clearly an area where a number of R&D Centres are keenly working all across. Success in characterizing lignin from various type of bio-mass and improving them for value addition shall open up vast opportunities. The potential of generating wind power from offshore could be greatly improved if the technology of putting turbines in sea environment is embraced. Hydrogen is another potentially emissions-free alternative fuel. Although not widely used today as a commercial transportation fuel, various R&D teams are working toward achieving the goal of clean, economical, and safe hydrogen production and developing hydrogen fuel cell vehicles.

The theme of 'HYDROCARBONS and BEYOND: CHANGING LANDSCAPE', PETROTECH 2012, puts forth a great opportunity to industry professionals to interact with one another and find solutions to the present energy crisis and lay the foundations for a sustainable and green tomorrow. I sincerely hope that the conference produces paradigm altering ideas, which on implementation would lead to a more equitable and intelligent tomorrow. I wish the event a great success.



R.S. Butola

Preface



Deepak Mahurkar
Leader Oil & Gas, PwC India

The themes adopted in the successive Petrotech conferences usually mirror the mood and market dynamics of the energy industry. Hydrocarbons and beyond: Changing Landscape is the theme adopted for the 10th International Oil and Gas Conference and Exhibition. The theme reflects India's efforts to secure energy for its economic growth by not just focussing on hydrocarbons but even looking beyond hydrocarbons. This is an approach that is reshaping the energy landscape of the country.

The hydrocarbon industry is at a very interesting juncture. The mood in the conventional E&P sector is not as enthusiastic as it was couple of years ago. On the other hand, there is an alluring promise of the unconventional hydrocarbon resources. Gas is expected to emerge as the fastest-growing fuel in India's energy basket over the next two decades. Small-scale LNG could help de-stress the gas market in the short to medium term. Similarly, refinery sector will continue its strong performance.

PricewaterhouseCoopers (PwC) was associated with Petrotech conferences in 2007, 2009 and 2010 as a knowledge partner and brought out milestone publications titled *Unfolding Horizons – Hydrocarbon Vision of India, Moving towards an Efficient Future and Petrotech 2010 - PetroFed PwC Publication: View from the Top – Oil & Gas Industry Survey on Global Energy Equilibrium*, respectively. These publications were well-received by the industry. Motivated by the success and realising the importance of this event to the hydrocarbon industry, PwC is delighted to be associated with the Petrotech 2012 conference in its various facets.

Building further on an industry survey conducted on various dimensions of the theme of Petrotech 2010, we decided to associate with Petrotech Society to conduct this survey again. The Petrotech Society took up the initiative of connecting with the industry captains and requesting them to participate in the survey, while we administered and managed the survey through our proprietary survey tools. We would like to thank Petrotech Society for their unstinted efforts in making the survey a success by securing healthy industry participation.

Top managers of national oil companies, private oil companies in India, international oil companies, and other energy companies participated in this survey and shared their valuable views on the various facets of the theme of Petrotech 2012.

While the theme is global, we believe discussing it in the Indian context is imperative. Thus, in this publication, we cover the various dimensions of the theme in detail and focus on the survey responses and their implications for the Indian hydrocarbon industry.

We take great pleasure in presenting this report to the stakeholders and industry watchers and hope that it complements the conference proceedings and all subsequent knowledge material that is expected to emerge out of this prestigious conference.

Foreword



Ashok Anand
Director General, Petrotech

The global economic meltdown has resulted in deceleration of India's economy. When seen in the context of the crippling impact the meltdown has had on few countries across the world, India's achievement on the economic front appear to be impressive. The future prospects though seem to be challenging for India. The annual GDP growth expectations of the country have been revised downwards by the Planning Commission over the last one year. The fiscal deficit has started reaching alarming levels. The industry has taken note of these symptoms and has stated re-visiting its future strategies. It has started thinking beyond the usual in order to attain their objectives. The key challenges, for the energy sector in India is the non-availability of adequate energy, its efficient utilisation and development of adequate infrastructure with due consideration towards the environment. Contributing around 40% in the country's energy mix the oil and gas sector plays a critical role in India's energy security.

This survey on the changing landscape of the hydrocarbon sector with particular reference to India conducted by knowledge partners, PwC on behalf of Petrotech Society brings to fore the opinion of the captains of oil and gas and energy companies operating in the country. This survey titled 'Fuel for thought: Senior management survey 2012' brings into sharp focus some of the key concerns of CEOs and existing and potential directors on the Board.

Around 88% of the respondents felt that India's energy policies need to be more aligned to meet the impending energy security challenge. Industry

is of the view that private sector participation is a must for meeting the energy security challenges. It also believes that the current policy and regulatory environment of the country need to more attractive for optimum private sector participation. 93% of respondents believed that oil diplomacy has become a norm rather than an exception. Respondents opined that India is a hydrocarbon prosperous nation and in its effort to secure overseas E&P assets it should not lose its primary focus of encouraging domestic E&P investments.

When asked about the enablers for shale gas and other non-conventional hydrocarbon sources, 97% of the respondents echoed that adequate tax incentives will be needed to attract investments to the sector. When asked about institutional capacity in R&D, 96% of the respondents agreed that technological innovations will be required to achieve it. When asked about weakening of public sector refinery companies due to under-recoveries, 94% of the respondents agreed that it'll leave a long-lasting dent on India's refining sector growth. Also astounding 95% respondents felt that the oil & gas industry will suffer from structural anomaly if not included within the proposed GST regime. 90% of the respondents agreed that gas will emerge as the fastest growing energy source in India's energy basket and 95% of the respondents were of the view that small-scale LNG terminals/FSU/FSRUs is a necessity to service the short to medium term gap in gas supply in India

The survey, thus, brings out the issues before industry for securing energy independence for the country.

Acknowledgements

Ashok Anand

Director General, Petrotech

Ever since its conception with a modest conference in 1995 for exchange of ideas, Petrotech's mentors and leaders of the oil industry have viewed it as a global forum for catalysing the growth of India's petroleum industry. With nine highly successful international conferences under its belt, Petrotech has now truly come of age and is an event looked forward to by the global petroleum industry. Petrotech 2012, based on the theme 'Hydrocarbons and beyond: Changing Landscape' promises to surpass all previous records in participation, content and results. The importance being attached to this event globally can be judged from the extent of participation by the international oil and gas community.

The Petrotech Society, formed in 1999 to take over the organisation of the conferences, has grown in to a full-fledged institution with multifarious activities. It provides a convenient platform for inter- and intra-industry interaction. It also facilitates coordinated effort in pan-industry issues of national importance. In line with its vision and objectives, the Petrotech Society has decided to conduct and publish the senior management survey on the critical dimensions of focus for the oil and gas industry. This will be the second edition of the CEO Survey, with the first one concluded in Petrotech 2010. The survey analyses the opinions of industry leaders on various aspects such as climate change and the role of the hydrocarbon industry, the investment climate in the hydrocarbon sector, the role and impact of policies and the

factors imperative in positioning of the oil and gas industry in the future. We believe that such a survey would help bring to light the opinions of the industry leaders on various aspects and thus would act as a good platform for discussing various issues during the course of this conference.

The Petrotech establishment has been working hard for the preparations of this prestigious event and extended full support to PwC, the knowledge partner, in accomplishing this task in such a short time. I would like to place on record my appreciation for the team spirit and cooperation of all the colleagues at Petrotech Society and PricewaterhouseCoopers. I would also like to thank all those who participated in the survey.

This senior management survey publication titled 'Fuel for thought: Senior management survey 2012' in your hands is the outcome and creation of team-work of our colleagues and PricewaterhouseCoopers, one of the knowledge partners of this prestigious event. We sincerely hope that this publication will unfold new horizons of optimism in the hydrocarbon sector in India.

Survey highlights

87%

respondents were confident that India's economy will continue to grow in excess of 6% per annum over the next two decades.

64%

respondents believe that, in the next decade, the strongest growth in domestic energy production is expected to come from the oil and gas sector.

88%

respondents were of the view that the country's energy policies need to be more aligned to meet the energy security challenge.

95%

respondents believed that increased private sector participation can help address India's energy security challenge.

68%

respondents opined that the current domestic energy regulatory and policy environment does not foster favourable conditions for desired private sector participation.

60%

respondents believed that India is rich in hydrocarbon and that while we should invest in overseas assets, our primary focus should be on promoting investments in the domestic E&P sector.

59%

respondents believed that the domestic energy policies, rather than hydrocarbon prospectivity, are driving Indian companies to look for overseas E&P opportunities.



70%

respondents believe that the success of USA cannot be replicated in India, despite indication of significant shale gas potential in the country.

92%

respondents opined that Indian companies are yet not able to focus on innovation and that other challenges draw more attention of the management.

88%

respondents confirmed that India's strategy to become a refinery hub will bear long-term dividends for the country.

55%

respondents agreed that Indian refineries are doing well on managing GRMs; however, 45 % believe otherwise.

94%

respondents confirmed that weakening of public sector refinery companies due to under recovery would leave a long lasting dent on India's refining sector growth



90%

respondents believed that gas will emerge as the fastest-growing energy source in India's energy basket.

85%

respondents believed that the process of gas price discovery should be independent of the government's policy for allocation and utilisation of natural gas.

70%

respondents believed that the oil and gas industry would continue to be a major emitter of greenhouse gases in India over the next 20 years.

63%

respondents believed that exploration and production of unconventional hydrocarbons is likely to increase environmental concerns.

75%

respondents believe that government's policies regarding environmental standards will get stricter over the years and will cause a disincentive for investment in the fossil fuel sector.

64%

respondents believed that the current policy and programme formulation of the government need to be more attractive to make the renewable energy sector investment friendly.



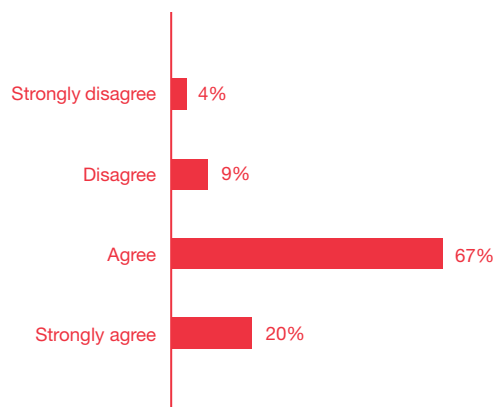
Growing demand for energy

The economy-energy connect

Even after the global economic meltdown, India registered a GDP growth rate of 6.9% in 2011-12. Though modest as compared to its blockbuster performance of 8.4% in the previous two years, it is still respectable, given the dire economic breakdown in some countries. Based on tracking several statistical indicators and projections of incremental capital-output ratios, the growth forecast of real GDP for 2012-13 is 7.6% (+/-0.25%).

This positive view is endorsed by the industry captains as well. The survey conducted indicates that 87% of the total respondents were confident that India's economy will continue to grow in excess of 6% per annum over the next two decades. Out of all the respondents, 20% 'strongly agreed' with this view.

Indian economy will continue to grow more than 6% per annum in the next two decades



In fact, economic growth and energy requirement go hand-in-hand. Embedded within this scenario is the challenge of fuelling growth with limited energy resources. Countries such as China and South Korea are riding the economic boom with strong performances in the energy-intensive manufacturing sector. Setting India apart is the dominance of relatively less energy intensive service sector in the economy. The country with one of the lowest per capita energy consumption will continue to demand significant amount of energy over the coming decades.

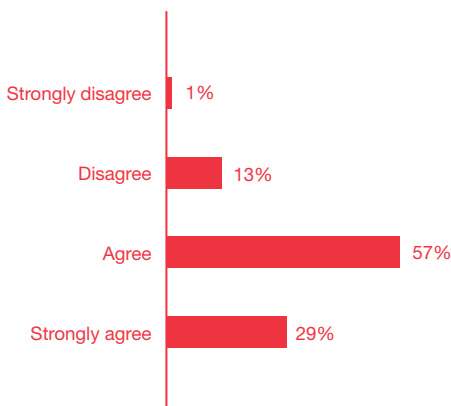
The high economic growth aspiration coupled with the limited domestic energy supplies translate into a serious energy security challenge—which the country continues to grapple with even today. Projections made by the Planning Commission under the XII Five Year Plan indicate that for a GDP growth rate of 9% per year, energy supply has to grow at around 6.5% per year. The ability to meet the energy requirement will depend upon the ability to expand domestic production in the critical sub-sectors such as petroleum, natural gas and coal, and meeting the balance requirement through imports.

Solving the energy puzzle

India is no doubt blessed with abundant natural resources. Coal has remained the mainstay of the country's energy portfolio followed by hydrocarbons—oil and gas. Other energy resources include hydroelectricity and nuclear power; coal and hydrocarbons put together account for more than 90% of India's energy mix. Also, hydroelectricity has great potential but needs to tackle environment, rehabilitation and resettlement issues. Moreover, the gestation period of projects is quite long. While nuclear is an option, it has limited potential in a given timeframe. Coal, with its associated challenges relating to environment and infrastructure availability will find its share in the total energy mix going down. This, effectively, leaves hydrocarbons to rise up to the occasion and meet the energy security challenge. While oil production, with the exception of last two years, has remained almost stagnant, gas has shown promise.

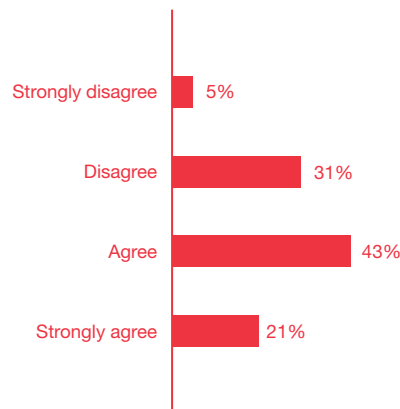
Our survey indicates, 86% of the total respondents affirmed that coal will continue to be the single largest energy source for India but will go down on its relative share, thereby increasing the burden on hydrocarbon and renewable energy sources. Nearly, 29% 'strongly agreed' to this view.

Coal will be the single largest energy source for India, but will go down on its share, thereby increasing burden on hydrocarbon and renewable sources



Given the enormous requirement for energy to support growth, India will have to tap all possible energy resources. Therefore, resources will not compete but will actually supplement each other. The survey indicates that 64% of the respondents believe that, in the next decade, the strongest growth in domestic energy production is expected to come from the oil and gas sector. Interestingly, another 36% of the respondents felt otherwise.

Strongest growth in domestic energy production in the next decade is expected to come from the oil and gas sector



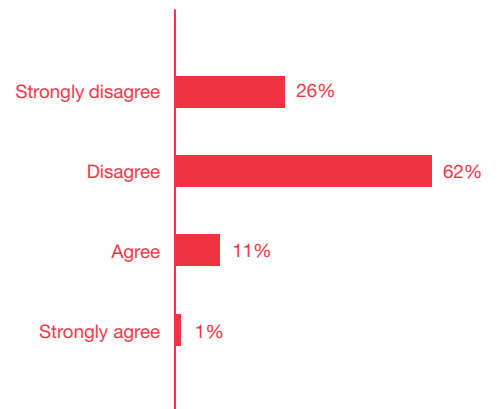
Are India's energy policies aligned to meet the challenge?

Policies adopted by the government, shapes the energy landscape of a country. The government usually looks at the energy sector on a holistic basis and plans integrated energy policies that factor in the pull-and-push of each source of primary energy. India, unfortunately, has a legacy of different ministries working towards development of different sources of primary energy. While there have been bright sparks of mutual collaboration between the ministries such as the coal bed methane (CBM) policy, it is more of an exception rather than a norm. Also, each of the resource ministries is at different stages of regulatory maturity. While the oil and

gas sector has progressed well in terms of transparent and objective policies for resource exploitation, other sectors such as coal have still a lot to catch up.

In our survey we asked the industry captains whether the current energy policies of India are adequate to meet its energy security challenge. A resounding 88% of the total respondents were of the view that the country's energy policies need to be more aligned to meet the challenge. At least 26% of the respondents had a 'strong' negative view on this. So what has India done wrong on the energy front?

Current energy policies of India are adequate to meet its energy security challenge

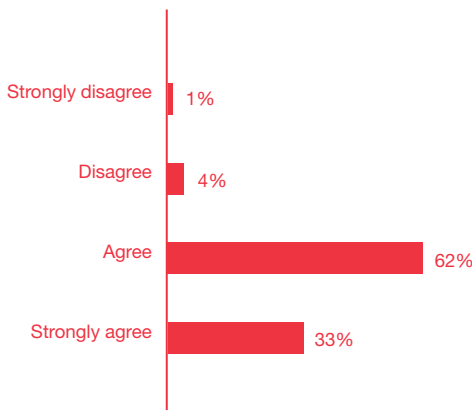


95% of the respondents were of the view that increased private sector participation can help address India's energy security challenge.

Over the last half decade, the government policies and actions have shaken investor confidence in the fossil fuels (coal, oil and gas) market. The hydrocarbon sector and in specific the gas sector, witnessed a slew of policies which were termed by investors as being against the spirit of the production sharing contracts (PSC) signed with the government. The final blow came with the allegations levelled by the government auditor on the functioning of the private companies. The most recent controversy pertains to the coal block allocation to private sector players.

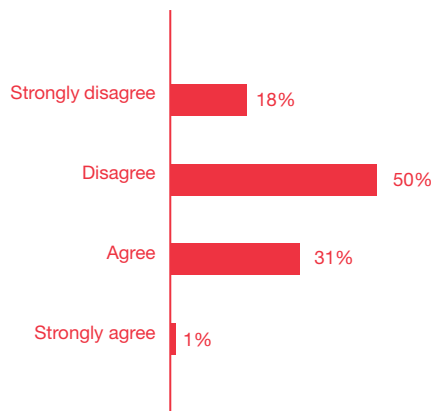
Around 95% of the total respondents believed that increased private sector participation can help address India's energy security challenge.

Increased private sector participation can help address India's energy security challenge



However, 68% of the total respondents opined that the current domestic energy regulatory and policy environment does not foster favourable conditions for desired private sector participation.

Current domestic energy regulatory and policy environment fosters favourable conditions for desired private sector participation



Energy saved is energy produced

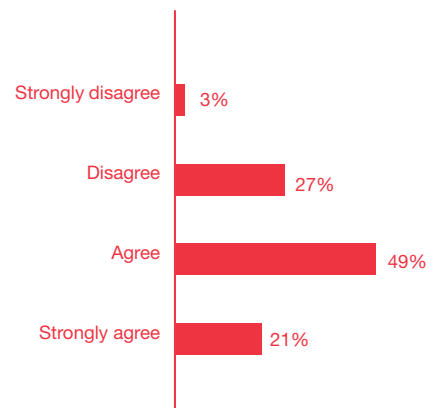
Not many will disagree that India has tremendous potential to utilise energy efficiently. Energy efficiency as a concept is fast catching up with numerous initiatives being taken by the government. Especially with fuel prices on the rise, this seems to be the quickest way to balance the demand-supply mismatch.

Subsidising commodities results into its sub-optimal usage. When the world is reeling under high price of petroleum products, India's demand for such products grows unabated. This is because the government insulates the economy from the vagaries of crude oil price by subsidising such sensitive petroleum products. This results in the inefficient use of premium products and at the same time puts excessive burden on the PSUs and the government. Therefore, correct pricing signals need to be sent to consumers to elicit a behaviour which is aligned to the realities of the market.

In a populous country such as India, subsidy administration and stopping leakages in the system also becomes extremely frustrating. While the government has tried to phase out subsidy on petroleum products, the political ramifications associated with any such move makes it difficult for the ruling party to take such a stand. Various ways of distributing subsidies to the economically weaker sections of the society including through direct disbursement of subsidy has been discussed and debated on various platforms. The government has also rolled out the ambitious unique identification (UID) scheme under the leadership of Nandan Nilekani.

We asked industry leaders whether the introduction of the UID scheme will make direct disbursement of subsidy to the poor a reality. While a total of 30% of the respondents were not convinced, a good 70% believed that the scheme could facilitate a direct disbursement of subsidy. Nearly, 21% of the respondents 'strongly agree' to this view.

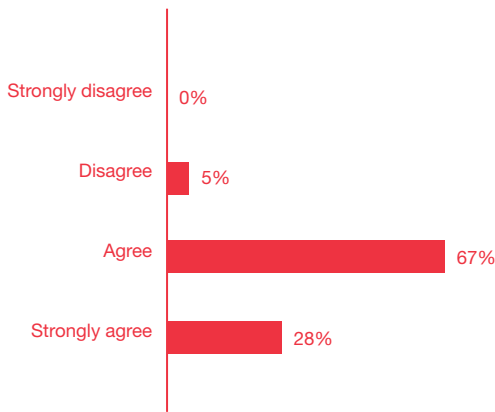
Direct disbursement of subsidy to poor will be a reality with the introduction of the UID scheme



Taxing times ahead

The oil and gas industry is the undisputed cash cow of the government. As compared to other countries India has one of the highest tax incidences on petroleum products. Any proposal to reduce taxes—whether central or state is met with stiff resistance. The government is expected to roll-out the unified Goods and Service Tax (GST) regime soon. Unfortunately, the oil and gas industry has been kept outside the purview of the GST which is expected to create undesirable structural anomalies within the sector. This is corroborated by the survey as 95% of the total respondents echoed the same view.

Oil and gas industry will suffer with structural anomaly if not included within the proposed GST regime



Key takeaways

1. India will continue to register strong economic growth over the next two decades requiring energy resources to fuel its economy.
2. Hydrocarbons (oil and gas) are expected to emerge as the strongest growing primary energy sources in India. Coal will continue to dominate but its share in the total primary energy basket is expected to come down.
3. The investors believe that the current energy policies of India need to be more aligned to meet the energy security challenge of the nation.
4. While private sector participation is a must for meeting the energy security challenges, the current policy and regulatory environment is not conducive for optimum private sector participation.
5. The price of petroleum products should reflect its true economic value and the subsidy should be phased out to obtain consumer behaviour aligned to market realities.
6. The non-inclusion of oil and gas industry in the GST value chain within the sector.



Securing energy through global co-operation

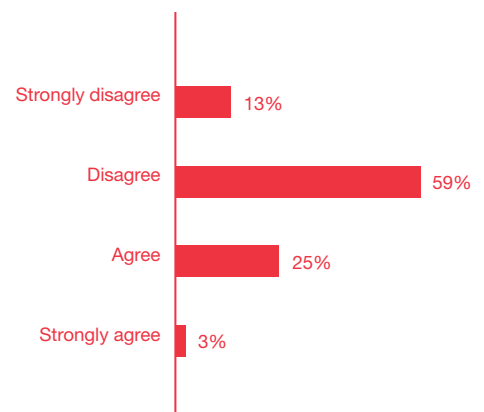
Co-operation versus competition

Taking equity oil positions in overseas exploration and production asset is one of the ways in which energy importing countries try to hedge against the commodity price risk. Historically, international oil companies (IOCs) have explored and produced hydrocarbons in various countries across the world. The national oil companies (NOCs) have now started their overseas exploits with a clear intent to meet its nation's energy security challenge. The NOCs of oil importing nations such as China, South Korea and also India are competing in the global E&P market to secure such opportunities.

The race to corner E&P assets with objectives which transcend beyond mere profit making to energy security has created a fiercely competitive global E&P market. Such competition has, in turn, resulted in unusually high valuations of E&P assets, which again is not good for such energy hungry countries. Given the high commodity prices countries are now realising the importance of co-operation over competition. Instances abound where NOCs from different countries, including China and India, have partnered to secure overseas E&P properties.

Surprisingly, 72% of the total respondents disagree with the view that energy importing nations such as China and India will co-operate rather than compete with each other in their hunt for overseas hydrocarbon assets.

Energy importing nations such as China and India will co-operate rather than compete with each other in their hunt for overseas hydrocarbon assets



Public versus private

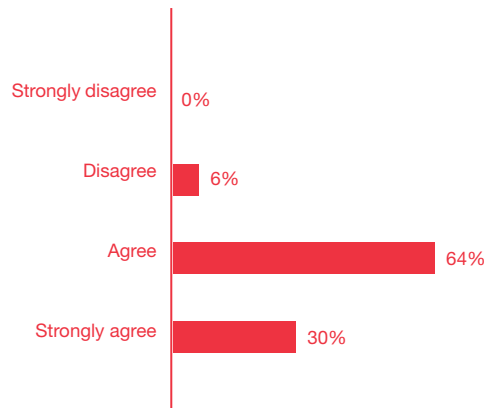
A look at the trend of overseas E&P investment reveals interest of both private and public sector companies. OVL, set up with the objective of securing equity oil, have made significant overseas investments and, in the process, have become the second largest public sector E&P company—second only to its parent company. Other public sector companies which have overseas E&P exposures include OIL, GAIL, IOCL, BPRL and GSPC. Private sector companies have also made investment including RIL, Essar, Jubilant, Videocon, etc.

The public sector companies face the unique challenge of securing necessary approvals from the government before committing such overseas investments. This happens because usually the quantum of investment required in E&P opportunities exceeds the financial limit imposed by the government on such public sector companies. Also, it is a well acknowledged fact in the E&P industry that the companies agile in making decisions are more certain to grab the overseas E&P opportunities. Unfortunately, the Indian public sector companies are usually constrained in their speed of decision-making owing to the various approvals required. This is corroborated by the industry with 90% of the survey respondents believing that the turnaround time of governmental decisions is the key to success in winning good overseas investment opportunities.

Oil diplomacy

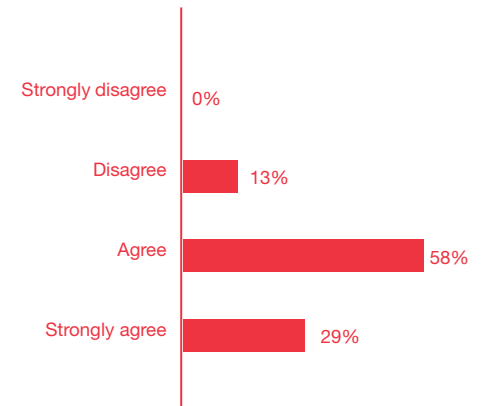
While the NOCs face the constraint of slow decision-making, they have the advantage of utilising government-to-government relations for securing overseas E&P opportunities. China has already demonstrated the might of oil diplomacy in securing such opportunities. India too has made such efforts on numerous occasions. The latter's seriousness to pursue this in a structured manner was evident when, for a limited period of time, a special position was created in the Ministry of Petroleum and Natural Gas which was manned by one of the Ministry of External Affairs officials. The importance of oil diplomacy can be gauged by the fact that 94% of the survey respondents were of the view that oil diplomacy has now become a norm rather than an exception.

Oil diplomacy has now become a norm rather than an exception



As discussed, a number of private oil and gas companies have invested in overseas E&P opportunities. Some argue that as long as it's an Indian company—whether public or private—the nation's energy security agenda is addressed when acquiring overseas E&P assets. If this is the case, then the private sector should not be denied the advantages of oil diplomacy. Nearly 87% of the survey respondents support the thought that private sector companies, like NOCs, will do well if the government offers diplomatic relations support during overseas acquisitions. Another thought is why not public and private sector Indian companies collaborate more to secure such overseas E&P opportunities. E.g., the successful collaboration between Videocon Industries Ltd and Bharat Petro Resources Ltd (BPRL a wholly-owned subsidiary of public sector refining and marketing company BPCL).

Private sector companies, like NOCs, will do well if the government offers diplomatic relations support during overseas acquisitions

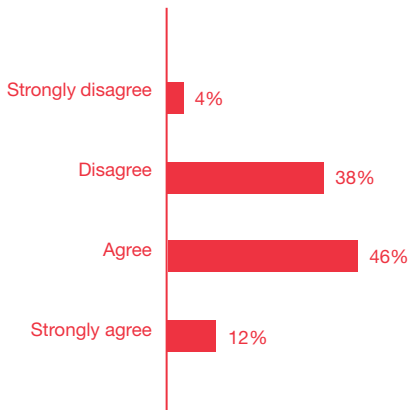


In versus out

Economic experts opine that when the flight of capital is outward bound it is a reflection on the hardships of doing business in that country. As per the estimates provided by the Directorate General of Hydrocarbons (DGH) only 22% of India's sedimentary area is moderately to well-explored leaving a large area still unexplored. India can, therefore, boast of one of the most unexplored sedimentary areas with significantly high potential for hydrocarbons.

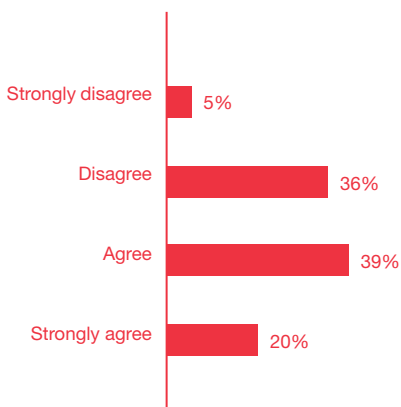
Despite the presence of opportunities in our own backyard, companies are willing to take high geo-political risks of doing business in other countries. About 60% of the survey respondents believe that India is rich in hydrocarbon and that while we should invest in overseas assets, our primary focus should be on promoting investments in the domestic E&P sector.

Domestic energy policies rather than hydrocarbon prospects are driving Indian companies to look for overseas E&P opportunities



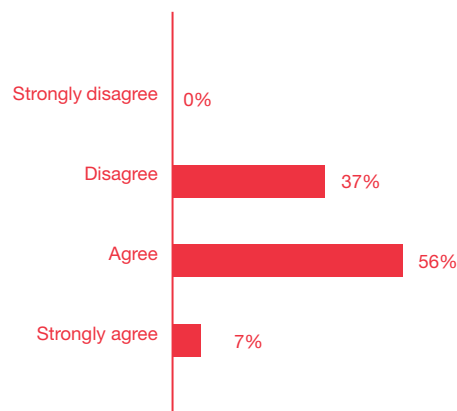
The question is why companies are looking out of India for E&P opportunities. Is our policy designed to encourage investment in the domestic hydrocarbon sector? This doesn't seem to hold true, since 59% of the survey respondents believe that the domestic energy policies, rather than hydrocarbon prospectivity, are driving Indian companies to look for overseas E&P opportunities.

We should invest in overseas assets but our primary focus should be on promoting investments in the domestic E&P sector



By analysing the overseas E&P investments, we find that companies have taken equity oil (or gas) positions in overseas assets to bring oil or gas into India (servicing the all important agenda of energy security). While bringing oil into the country or even swapping it is possible given the maturity of physical and paper trade of crude oil, the same cannot be said about natural gas. Importing natural gas either through pipelines or LNG route requires tact, persistence and above all a market which can afford the costlier LNG. Around 62% of the survey respondents were positive that Indian companies will be able to bring their share of equity gas from their overseas assets.

Unlike coal in Indonesia, Indian companies will be able to bring their share of equity gas from overseas



Investing in overseas E&P assets is advisable but can at best serve to supplement the domestic supply. The focus should be on harnessing the domestic resources of the country. Add to that the multiplier effect such domestic investment has on the economy and national employment, we have a very strong case of encouraging domestic E&P investment.

Key takeaways

1. While there is a compelling case of co-operation rather than competition between energy hungry nations such as India and China, it will be an exception rather than a norm.
2. The turnaround time of governmental decisions is the key to success in winning good overseas investment opportunities by Indian public sector companies.
3. Oil diplomacy has now become a norm rather than an exception and support should be extended to the private sector companies as well.
4. India is a hydrocarbon prosperous nation and in its effort to secure overseas E&P assets it should not lose its primary focus of encouraging domestic E&P investments.
5. The domestic energy policies rather than hydrocarbon prospectivity is driving Indian companies to look for overseas E&P opportunities.



New kid on the block

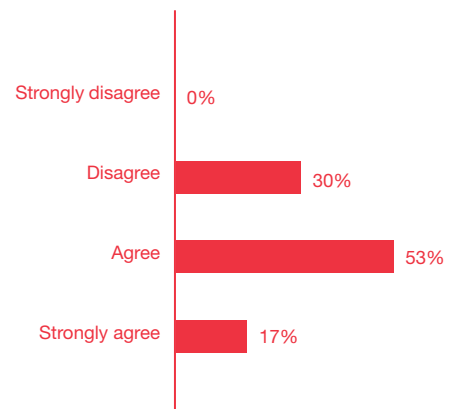
The game changer

The world has witnessed shale gas revolution in the US and its impact on the energy security agenda of a country. From being an importer to becoming an exporter of gas, USA has turned the tables. But this did not happen overnight. The technological innovation coupled with constant fiscal support from the government to encourage people who thought ‘unconventionally’ led to this transformation. The result is for everyone to see. Will it work elsewhere? Will it work for India?

Just do it

From the perspective of prospectivity, India is one of the shale gas rich countries with a few sedimentary basins possessing shale gas potential. The ONGC has gone ahead and drilled exploratory wells to test shale gas plays in eastern India and the results have been encouraging. In our survey we asked whether or not the success of shale gas in USA can be replicated in India. The answer mirrors the current concerns of conventional assets operators which, perhaps, they believe will get even more severe in unconventional assets. A good 70% of the respondents believe that the success of USA cannot be replicated in India, despite indication of significant shale gas potential in the country.

Success of shale gas in the US cannot be replicated in India



To gauge India’s potential, we need to analyse whether or not the factors (other than prospectivity) which contributed to the success of shale gas in the US are present in the country as well.

In our survey we asked the respondents to rate the various challenges associated with shale gas development in India. With 72% land acquisition is the top most concern of the industry. Also, the mineral ownership rights in the US are with the owner of the land. So the landowners saw their interest serviced through royalty paychecks

for shale gas production. In contrast, the Indian government owns the sub-surface mineral rights, which creates a conflicting situation. Besides land, 62% of the total respondents were concerned about the water management issues associated with shale gas operations. The groundwater contamination has been the most contentious issue facing the shale gas industry.

Challenges for shale gas development in India



While the above two concerns are more specific for shale gas operations the next area of concern is something which the conventional hydrocarbon industry is also currently grappling with. It relates to gas pricing and marketing freedom which 60% of the respondents felt was necessary to encourage the domestic shale gas development. Other major challenges include technical know-how (52%), non-availability of equipment required for shale gas operations (49%) and shortage of manpower (36%).

Another major challenge identified by the industry is obtaining necessary clearances and permissions (most importantly the environmental clearance). We have witnessed the plight of operators who have suffered financial and reputational losses owing to delays in being granted such environmental clearances. Even with a valid petroleum exploration licence (PEL) in hand, the operators feel frustrated since they cannot start operations on their block.

‘Political issues’ or ‘too much political interference’ were also cited as challenges to shale gas development. As the US government supported the development of shale gas technology during its early days, the industry in India feels that similarly the government needs to have a strong political will with minimum interferences to make it happen in the country as well.

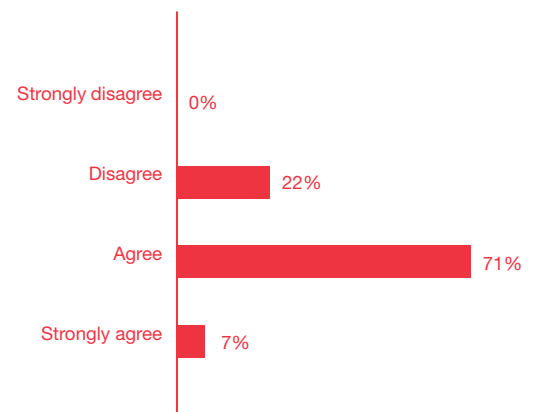
Above all, the government policy towards shale gas development may either emerge as the most important challenge or as a solution for all the above challenges. The challenges and risks identified by the industry needs to be addressed by the policy. The draft shale gas policy has taken cognisance of the various operational challenges specific to shale gas development. In particular, the following assurances offered in the policy are quite encouraging:

- Obtaining all statutory, regulatory and security clearances before bidding
- The Ministry of Environment and Forests (MoEF) prescribing a panel of agencies competent to carry out environment impact assessment (EIA)
- The government seeking in-principle approval from the respective state governments prior to bidding, including facilitating land acquisition

Fiscally speaking

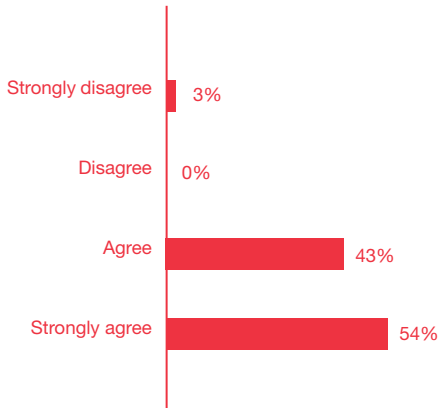
The draft shale gas policy proposes a CBM-like fiscal regime, i.e. production-linked payments to the government with no cost recovery and no production sharing. Given the scrutiny to which operators of conventional assets are being subjected under the current PSC regime, it is no surprise that 78% of the total respondents supported a departure from the PSC regime for shale gas contracts. With little or no experience of shale gas operations in India, this step may bode well for this new unconventional industry.

The proposed production-linked payments with no cost recovery for shale gas is better than the PSC regime



Also, a whopping 97% of the respondents were of the view that the unconventional hydrocarbons industry requires adequate tax incentives to attract investments. The balance between the risks and rewards needs to be struck to build investor confidence.

Unconventional hydrocarbons industry requires adequate tax incentives to attract investments



In order to develop the country's natural resources, the government needs to take a long term view of the sector and prepare a strategy for optimum development of the sector. The government would do well to adopt a consultative approach in developing a long-term strategy for the sector and developing a policy framework which provides incentives and benefits for all the stakeholders. This is not an easy task given the multiple stakeholders involved in shale gas development.

We have witnessed Indian companies such as RIL and GAIL take equity positions in shale gas assets in the US. Let's hope the learnings can be imbibed and put to constructive use in India to develop this unconventional resource to solve the energy security riddle that the nation is facing.

Key takeaways

1. It will be difficult for India to replicate the success of the US in shale gas resource development unless the policy of the government balances the risks and rewards to attract investors.
2. Land acquisition, water management, freedom in pricing and marketing gas, obtaining environmental clearances, and equipment availability are the key challenges for the development of shale gas in India.
3. A fiscal regime involving royalty and production-linked payments will be more effective than a production sharing regime.
4. The unconventional hydrocarbons industry requires adequate tax incentives to attract investments.



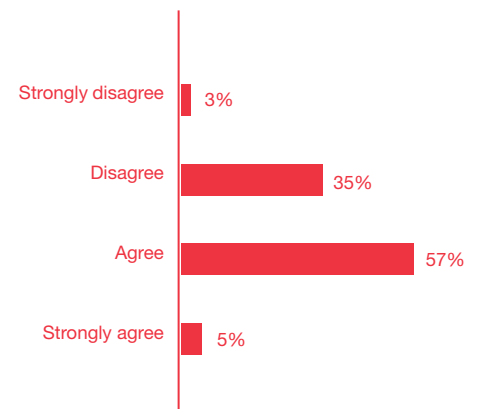
Innovation: The game changer

Cutting edge technology

Technological innovation is perhaps the most potent tool in fulfilling the world's unending quest for energy. The world is trying to discover newer and better ways of doing the same things or doing new things altogether. Right from exploration to refining and marketing, companies are exploring avenues to innovate. The hydrocarbon industry is constantly evolving and keeps throwing up new challenges, to which the industry responds with innovative ideas. Deepwater exploration and production and economic production of shale gas were some of the challenges that were overcome thanks to the development and usage of cutting-edge technology by industry players. So how has India performed as compared to the world?

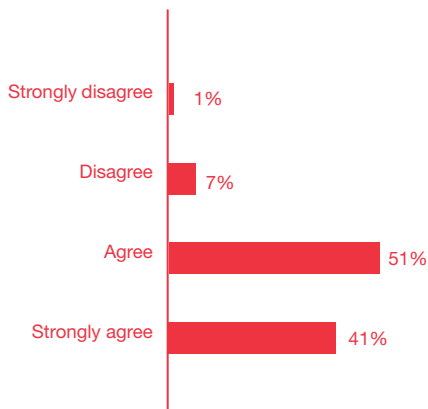
In our survey, we asked respondents whether or not India's oil and gas companies are adopting the latest technologies. It was comforting to learn that 62% of the respondents felt that the Indian companies were indeed adopting the latest technologies. Companies like Reliance Industries Ltd. have on one hand set up one of the most complex refineries in the world, and on the other hand have developed deepwater E&P assets using the best of the available technologies. IOCL has a dedicated R&D department with a director-level position signifying the importance placed by the company on R&D initiatives.

Indian O&G companies are adopting latest technologies

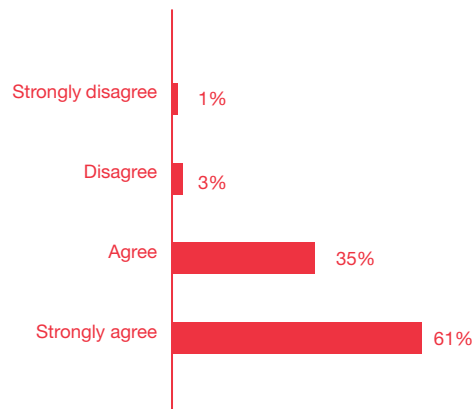


However, it was disheartening to learn that 38% of the total respondents felt that Indian companies are not adopting the latest technologies. 92% of the total respondents felt that Indian companies are yet not able to focus on innovation and that other challenges draw more attention of the management.

Indian companies are yet not able to focus on innovation, other challenges draw more attention.



Stability in policies is a must to encourage companies to adopt expensive cutting-edge technology



Advanced research and development facilities are the need of the hour. But what good is hardware without the requisite software? There is a need for skilled manpower to man and run these research facilities. 84% of the total survey respondents were of the view that technological innovations are a function of the availability of skilled manpower in the industry. India is, for that matter, blessed with the best of the minds—read ‘software’—which is evident from how well Indians have done in the R&D field given the necessary ‘hardware’ support.

Technological innovations are a function of availability of skilled manpower in the industry

Role policies play

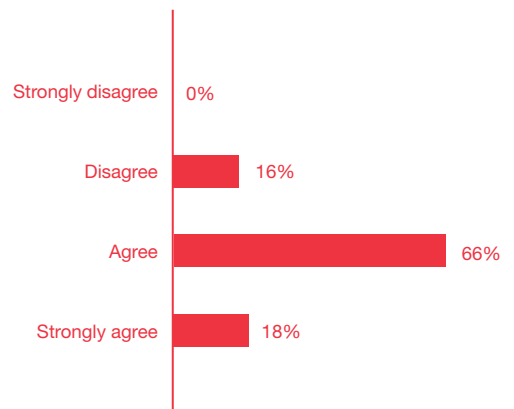
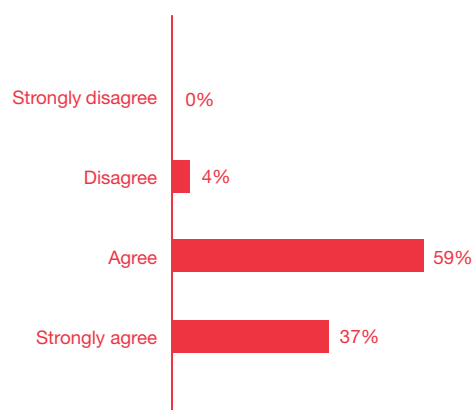
Petrobras has emerged as the undisputed leader in deepwater operations. What made it happen was the unstinted support provided by the Brazilian government to the NOC to undertake intense deepwater research and development activities for more than a decade. Another example of government’s policy support towards technological innovation was the assistance provided by the US government to the domestic shale gas ‘crusaders’. Assistance provided by the government research institutions and fiscal support by the government to share the costs of drilling operations made it possible for the ‘mavericks’ to make an indelible mark in the energy history of the world.

96% of the total industry respondents were of the view that stability in policies is a must to encourage companies to adopt expensive cutting-edge technology in India. Given the limited and non-renewable nature of hydrocarbon resources the government should encourage intense research and development activities through a stable and attractive policy framework.

Hardware and the software

96% of the survey respondents were of the view that technological innovations will increase with better institutional capacity in R&D. While companies such as ONGC and IOCL have set up centres of excellence for encouragement of primary and applied research in their respective domains, there is still room for reinforcement of such institutional capacity in the hydrocarbon sector.

Technological innovations will increase with institutional capacity in R&D



Key takeaways

1. While Indian oil and gas companies have been proactive in adopting latest technologies, there are few areas where technology adoption and upgradation have been slow.
2. Stable, transparent and supportive government policies are required for companies to adopt expensive cutting-edge technologies.
3. There is tremendous scope for adding institutional capacity in the area of hydrocarbon R&D. Such institutional capacities coupled with availability of skilled manpower will provide a winning combination for India.



Future of petroleum refining: Challenges and opportunities

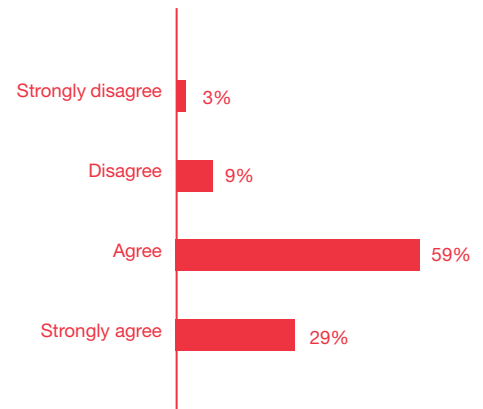
Hub of opportunities

The demand for petroleum products is outpacing the refining capacity addition, which has led to record high capacity utilisation of refineries across geographies. The large gap between increasing demand and installed refining capacity in the Atlantic region will cause the product movement from the Pacific region to the Atlantic region. This trend presents an attractive opportunity for India to step up refining capacity for exports. Competitive advantages i.e. geographical location and cost competitiveness, shall pave its way to become a major refining hub.

India consumed around 148 million tonnes of petroleum product during 2011-12 and is expected to consume 184 million tonnes by 2016-17. This large domestic demand provides a caution against volatility in the global export market. Therefore, India is strategically well positioned to develop as a refining hub.

The fact that India's strategy to become a refinery hub will bear long-term dividends for the country has been emphasised by the respondents of the survey. With 30% of respondents strongly agreeing, in total 88% of the respondents agree with this fact. The response clearly indicates that downstream sector in India is poised to grow at a rapid pace.

India's strategy to become a refinery hub will bear long-term dividends for the country



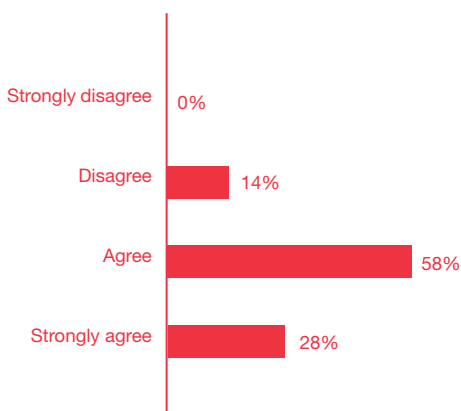
Integrated hubs

The transition to becoming a refining hub will necessitate the integration of refineries with petrochemical plants. To facilitate the integration, the government of India notified the petroleum, chemicals and petrochemicals investment region (PCPIR) policy in 2008. PCPIRs will provide specifically delineated investment regions for the establishment of manufacturing facilities for domestic and export-led production in petroleum, chemicals and petrochemicals, along with the associated services and infrastructure. Various state governments, viz. Andhra Pradesh,

Gujarat, Orissa and West Bengal, have expressed their interest in developing such PCPIRs.

Manufacturing units operating within the PCPIR will be more competitive than the units operating on stand-alone basis, as the former will make optimal use of resources. 86% of the respondents agree that the integrated refinery and petrochemical projects will need chemical industry hubs like PCIPR and companies developing on stand-alone basis would be sub optimal. However, 14% of the respondents don't agree with this view. One of the arguments of these respondents is that the market for all the products manufactured within the PCPIR may not exist within the same region. Thus, they will demand more resources and infrastructure for linking demand centre with manufacturing units. Further, such regions may create a regional imbalance in terms of social development.

Integrated refinery and petrochemical projects will need chemical industry hubs like PCIPR; individual companies developing would be sub-optimal



Clean fuels

With increasing environmental concerns, demand for clean fuel is sure to rise. As improving fuel quality demands significant investments from refiners, the government of India

plans to transition to higher fuel-quality standards in a phased manner. Presently, 20 cities are following Bharat stage IV (equivalent of Euro IV) fuel specifications.

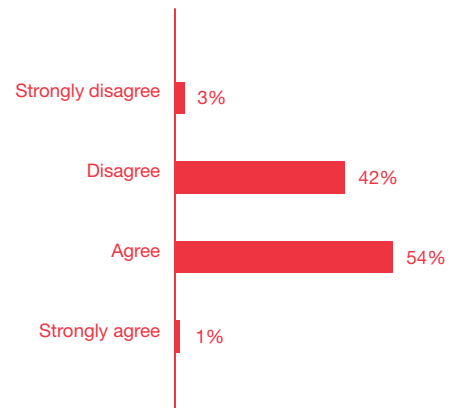
Another way to achieve the clean fuel norm is through increasing use of bio-fuels. The bio-fuel policy of the government of India proposed to achieve 10% mandatory blending of ethanol with gasoline to become effective from October 2008, and 20% blending of bio-fuels, both for bio-diesel and bio-ethanol, by 2017. However, little progress has been made so far owing to the constrained supply of bio-fuel. Indian refiners made significant investments in Jatropa (source of bio-fuel); however, results so far have not been very encouraging. The research efforts are on to produce third or fourth-generation bio-fuel (algae, lignocellulosic ethanol etc.) which may potentially solve the supply constrains.

Monetising opportunities: Refinery upgradation and GRM

Changes in the market place like changing demand pattern and stringent environmental norms demand upgradation in the existing system in order to protect the market share and gross refining margin (GRM). To improve the GRM refineries may adopt various mechanisms including hedging the risk of crude price volatility, logistics optimisation and upgradation of refinery configuration.

The survey enquired the respondents about the extent to which Indian refineries are endeavouring to improve GRMs. 55 % of the respondents agreed that Indian refineries are doing well on managing GRMs; however, 45 % of the respondents didn't agree. The difference of opinion among respondents indicates that though Indian refiners are making significant efforts to improve the GRM, there is still room for improvement.

Indian refineries are doing well on managing GRMs

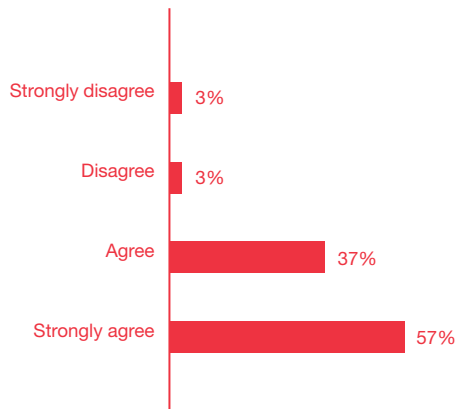


Subsidy regime

The Indian petroleum product market is far from competitive as various petroleum products (diesel, LPG, kerosene) operate under a subsidy regime. The mounting burden of under-recoveries has seriously affected the operational functioning and financial health of oil marketing companies (OMCs). As on October 2012, OMCs were incurring a daily under-recovery of 437 crore INR on the sale of diesel, PDS kerosene and domestic LPG. During April - June 2012 OMCs reported a total under recovery of 47,811 crore INR. It is understood that OMCs may not be able to function properly and sustainably under the weight of growing under-recoveries, shrinking liquidity and significantly impaired corporate flexibility.

In this regard, the survey sought the view of respondents. 94% of the respondents agreed, of which 57% strongly agreed, that weakening of public sector refinery companies due to under recovery would leave a long lasting dent on India's refining sector growth. The respondents are unanimous in opinion that the subsidy regime will hinder the growth of refining sector.

Weakening of public sector refinery companies due to under recovery would leave a long-lasting dent on India's refining sector growth



Key takeaways

1. In the present market scenario and changing energy landscape, India has the opportunity to become a refining hub. India's strategy to become a refining hub will bear long-term dividends for the country.
2. To optimise on cost and support the transition to a refining hub, integration with petrochemical and other downstream industry seems imperative.
3. Indian refiners have managed the GRM fairly well, though significant opportunity to improve exists.
4. Weakening of public sector refinery companies due to under recovery would leave a long-lasting dent on India's refining sector growth.



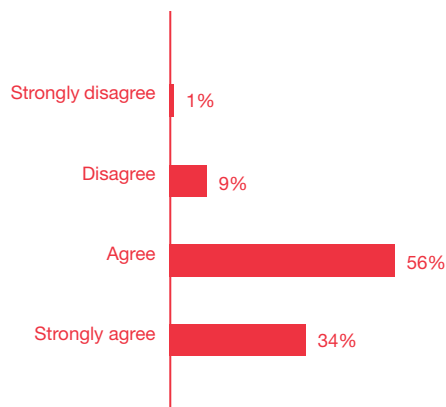


Moving towards a gas era

The leap of faith

90% of the survey respondents believe that gas will emerge as the fastest-growing energy source in India's energy basket. This is a belief reinforced by a string of gas discoveries reported by oil and gas companies in India as well as a slew of LNG projects planned in the coming years. India has always been a supply-constrained gas market with demand far outstripping demand. It is reported that power project developers have approached the Central Electricity Authority (CEA) for gas allocation totalling in excess of 600 MMSCMD. Such a huge demand from just one industry translates into a substantial untapped potential demand for gas in India.

Gas will emerge as the fastest growing energy source in India's energy basket



With its inherently benign nature vis-à-vis other alternative fuels—both solid and liquid—gas as a fuel definitely has an advantage. Development of gas resources also fits into the environmental beneficiation agenda of governments across the world. Gas trade through pipelines and LNG ships is picking up steadily over the years. New corridors of gas trade are fast emerging. Qatar has emerged as a major LNG supply centre with the focus now shifting to Australia. The US is expected to become a net exporter of gas by 2022 with a number of LNG regasification terminals being converted to LNG liquefaction terminals. From the demand side, Japan is expected to continue its reliance on LNG imports especially in the aftermath of the recent Fukushima incident.

Potential hurdles

The gas market is unique owing to its inherent characteristics. Unlike oil, physical movement of gas becomes a challenge owing to the volume it occupies at ambient pressure and temperature. Monetisation of upstream gas assets requires upfront investment in the entire gas value chain. These upfront investments include construction of pipelines and/or LNG liquefaction terminals, LNG ships, LNG regasification capacities and setting up new gas based units or expanding the existing ones. Financial closure of gas projects is occasioned only when the

project sponsor has tied up investments along the value chain.

As if all these challenges were not enough, an overarching challenge is that all these tie-ups have to be done within the policy and regulatory framework applicable to the gas sector of the countries involved. Given the monopolistic nature of the gas infrastructure business, government regulation is intense and unavoidable and the Indian market is no different.

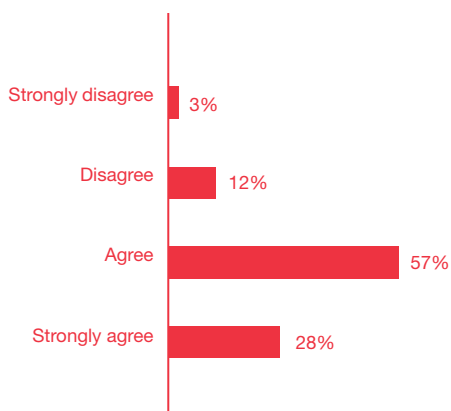
The development of the Indian gas market is currently facing few policy and regulatory challenges. Perhaps the biggest challenge is the government's policy around gas pricing. Having taken the underground risk of resources, once successful at establishing economic reserves of hydrocarbon, E&P investors look for predictable gas prices on a long-term basis.

The litmus test of discovering an 'arm's length price' for domestically produced gas has become a struggle for companies. Ostensibly the emphasis is on price discovery through competitive bids from non-affiliates under the government's gas utilisation priorities. The contracts (both NELP and CBM) stop short of explaining what exact steps constitute an arm's length gas price discovery process, stating where it ends, and clarifying if the process is to be self-governed and operationalised or will the government expect producers to obtain approvals from the line ministry at all stages. These ambiguities have led to producers being over cautious by seeking reviews by government, and in turn, governments taking the required time to provide approvals. The lack of accurately and objectively set out parameters or process is leading to government intervention as a rule rather than an exception.

The current uncertainty relating to gas prices, both for existing and new discoveries under development, cause discomfort to investors and bankers

alike. 85% of the survey respondents believe that the process of gas price discovery should be independent of the government's policy for allocation and utilisation of natural gas.

Gas price discovery process should be independent of Government's policy for allocation and utilisation of natural gas



Good things come in small packages

Before RIL's KG-D6 gas discovery, a number of LNG projects were planned across peninsular India—both on the western and eastern coasts. However, with the promise of significant domestic supply upside on the back of the KG-D6 gas field these projects, especially on the east coast, were shelved. After two years of commencement of commercial production, the performance of the KG-D6 field has not kept up with its promise. This has prompted project developers to revive or plan afresh another round of LNG import facilities.

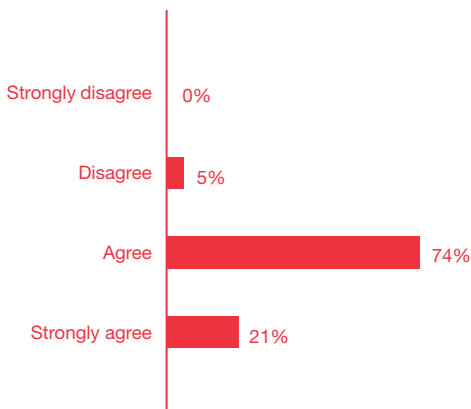
In any business, one needs to be at the right place at the right time. The LNG business is no different. Being a cyclical industry, missing one good cycle means waiting for the next cycle to come by. While India was de-stressed and was

relaxing with the prospect of doubling up its domestic gas production, other countries were labouring hard to hammer out long-term LNG contracts with the upcoming LNG supply sources. India needs to catch up fast in order to make up for the lost time.

The misery of LNG project developers can be understood by analysing the situation in the two anchor customer industries, viz. the fertiliser and power, without which large-scale LNG projects may not see light of day in India. The fertiliser sector would continue to receive the first priority in allocation of domestic gas since it releases subsidy pressure on the government and therefore would not look for costlier LNG imports. Regulated consumer electricity tariffs and competition with cheaper coal makes LNG-based power generation truly uncompetitive. With two of the largest consuming sectors not interested in costlier LNG imports, it becomes difficult to set up large and costly LNG regasification terminals.

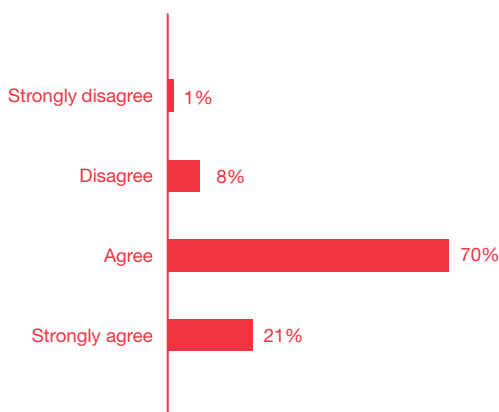
While size does matter, in the case of LNG in India, smaller is better in terms of low investment, tying up premium customers with small gas appetite and, above all, a much smaller gestation period. These small-scale LNG terminals include floating storage unit (FSU) or floating storage and regasification unit (FSRU). 95% of the survey respondents were of the view that small-scale LNG terminals/FSU/FSRUs are emerging as a necessity to service the short to medium term gap in gas supply in India. The government should, therefore, acknowledge the investor's dilemma and facilitate such infrastructure development.

Small-scale LNG terminals/FSU/FSRUs are emerging as a necessity to service the short to medium term gap in gas supply in India



Swapping of gas has begun but on an exceptional rather than regular basis. Recent guidelines on gas swapping issued by the government will certainly give some confidence to the market players. If done on a regular basis, swapping will enable speedy development of the LNG market in India. The industry supports this view, with 91% of the survey respondents agreeing that swapping will encourage development of the LNG market in India.

Swapping of gas will boost LNG industry in India



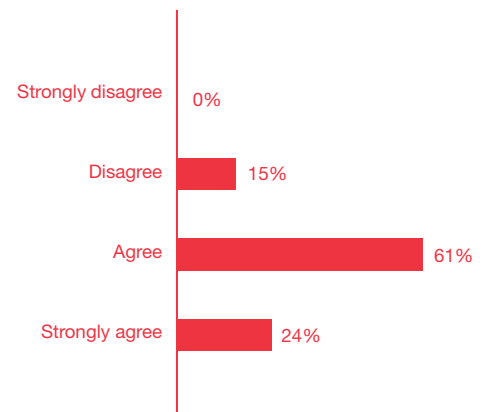
Empowerment for accountability

After prolonged debates and discussions, the government finally decided to introduce the Petroleum and Natural gas Regulatory Board Act (PNGRB Act) in March 2006. The PNGRB was set up in October 2007 under the provisions of the Act, which was to operate as a regulator independent of the government. The step taken by the government was applauded by the industry as a forward-looking initiative. However, the way the government retained control over the regulator by not delegating enough powers and the ensuing turf war has taken the industry two steps back.

However, the Board certainly achieved major milestones during its regulatory journey so far. Regulations were introduced at regular intervals to ensure that downstream sector regulations precede major market developments. Multiple licensing rounds for award of city gas distribution (CGD) licences were organised by the regulator. Authorisations granted by the government were acknowledged and registered by the Board. Further, multiple pipeline licences were auctioned by the Board. However, the manner in which all this was achieved made the investors unhappy.

85% of the survey respondents were of the view that the regulator needs more powers to motivate investors who are keen to engage in the gas infrastructure business (both transmission and distribution) in India. The government would do well to reinstate investors' confidence in the regulator and allow stable and transparent policies to be introduced and implemented for the efficient development of the gas sector in India.

Regulator needs to have more powers for motivating to investors in the gas infrastructure business (both transmission and distribution)



Key takeaways

1. Gas will emerge as the fastest-growing energy source in India's energy basket owing to increased availability, cost efficiency and its inherent environmental advantages over alternatives.
2. The process of gas price discovery should be independent of the government's policy for allocation and utilisation of natural gas.
3. The government should facilitate gas swapping to encourage gas and, in particular, LNG market development in India.
4. Given the inability of the customers from the fertiliser and power sectors to offtake LNG, it becomes imperative to develop small-scale LNG terminals/FSU/FSRUs to service the short to medium-term demand-supply gap in India.
5. The downstream regulator needs to be adequately empowered to win investor confidence in the gas infrastructure business (both transmission and distribution).



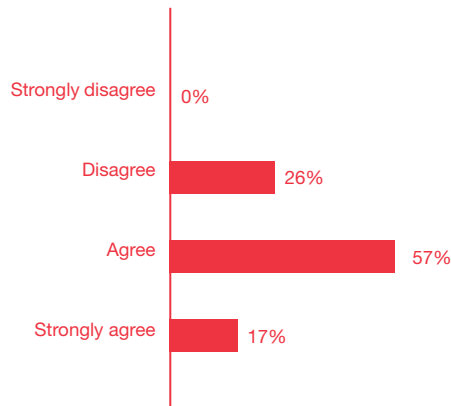
Environment, health and safety

With great powers come greater responsibilities

Sustainable growth is the new mantra for both the government and the corporations. Business managers across the world are gradually realising that they can ignore the environment only at their own peril. Thus, there is a heightened sense of responsibility towards the environment among all stakeholders.

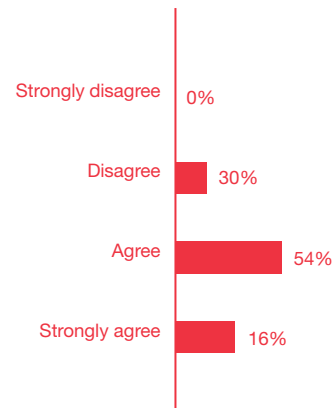
The global energy mix projections made by various agencies indicate the critical role that the hydrocarbon sector will play in meeting the future energy needs of the world. 74% of the survey respondents were of the view that strongest growth in global energy production in the next 10 years is expected to come from the oil and gas sector.

Strongest growth in global energy production in the next 10 years is expected to come from the oil & gas sector



Further, 70% of the survey respondents believed that the oil and gas industry would continue to be a major emitter of greenhouse gases in India over the next 20 years.

Oil and gas industry will continue to be a major emitter of greenhouse gases in India over the next 20 years

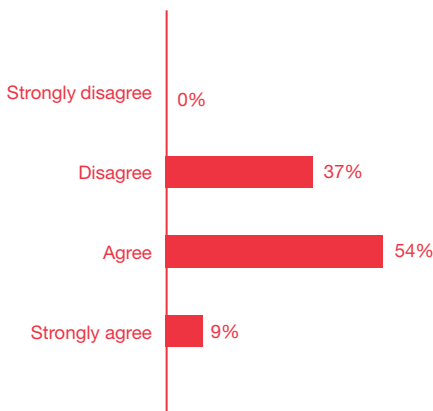


Oil and gas industry will continue to be a major emitter of greenhouse gases in India over the next 20 years

This will be a tightrope walk for the hydrocarbon industry, especially when it has almost exhausted the 'easy oil' options and is now keen to develop the unconventional hydrocarbon resources. Wastewater management and disposal of toxic waste is a major concern for the shale gas business. 63% of the survey respondents believe

that exploration and production of unconventional hydrocarbons is likely to increase environmental concerns. It is interesting to note that in the 2010 CEO survey, a similar number (60%) of respondents had disagreed with this view. The raging debate in various European countries over the potential environmental impact of operating unconventional assets could be a potential reason for a reversal of this stand.

Exploration and production of unconventional hydrocarbons is likely to increase environmental concerns

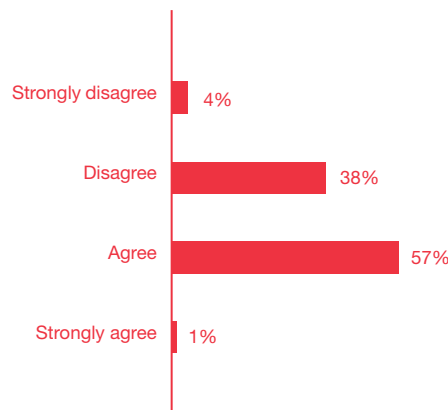


Therefore, given the importance and energy-intensive nature of the hydrocarbon industry, it is but natural to expect and perhaps demand a greater amount of respect and responsibility towards the environment from the hydrocarbon industry.

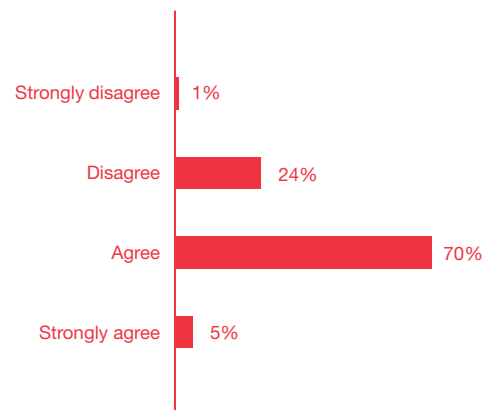
Regulations to impact business dynamics

Accidents in the oil and gas industry are usually associated with large-scale loss and destruction including loss of lives. Oil spills, fires at fuel storage locations, etc. have caused enough damage to the reputation and financial position of oil companies. Environmental regulations pertaining to oil and gas sector have become increasingly stringent over the years. Increased regulatory oversight translates into increased cost of compliance adding to the overall cost of operations.

India's regulations and environmental concerns are satisfactory and meet global standards



Government's policies regarding environmental standards will get stricter over the years and will cause a disincentive for investment in the fossil fuel sector



While 58% of the survey respondents confirm that India's regulations and environmental concerns are satisfactory and meet the global standards, a substantial 42% of the survey respondents feel otherwise. 75% of the survey respondents, however, believe that government's policies regarding environmental standards will get stricter over the years and will cause a disincentive for investment in fossil fuel sector.

Technological imperatives

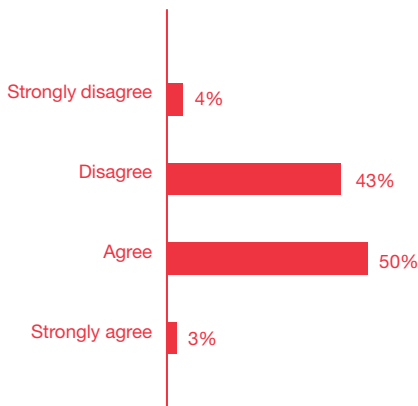
73% of the survey respondents believe that advanced carbon sequestration and storage techniques are very expensive and their implementation does not justify the aim of doing business. While the industry has expressed its interest in working together with other sectors for carbon capture and sequestration, such an exercise is unlikely to arise solely out of self-interest and would require facilitation from the state and central governments working in tandem.

Health is wealth

Occupational health and safety standards have been a cause of concern for India. Over the years Indian business managers have acknowledged the need to align with the global standards. International oil companies operating in India have also set high standards for their Indian counterparts. It is emerging as a key performance indicator for companies and the management alike.

About half of the survey respondents are of the view that occupation health and safety policies in India's oil and gas sector are aligned to the global standards. An almost equal (47%) of the survey respondents do not endorse this view. It could, therefore, be inferred that India still needs to take conscious steps to catch up with the global standards on occupations health and safety standards.

Occupation health and safety policies in India's oil and gas sector are aligned to global standards



Key takeaways

1. The strongest growth in global energy production in the next decade is expected to come from the oil and gas sector. Oil and gas industry would continue to be a major emitter of greenhouse gases in India over the next 20 years.
2. Environmental concerns relating to exploration and production of unconventional hydrocarbons are gaining momentum. As compared to the Petrotech 2010 survey this year's survey witnessed reversal of the industry stand on this issue. The industry now believes that harnessing unconventional hydrocarbon resources is likely to increase environmental concerns.
3. The industry fears that future policies on environmental standards are likely to cause disincentives for investment, while at the same time agreeing to the fact that India's current environmental standards are at par with international standards. The best way to optimise this would be to involve the industry members at various stages of policy development, while not lagging behind in the efforts for improving the environmental standards.





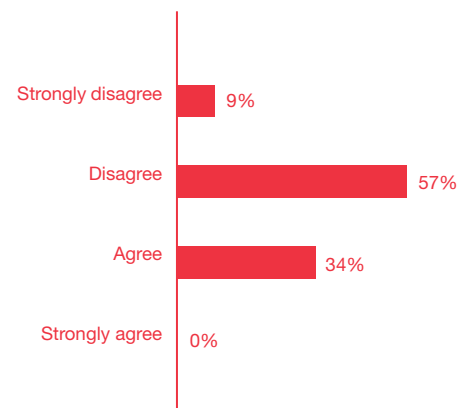
Renewable energy

Policy regime to support renewable energy

The way the world, in general, and India in particular have been producing and utilising energy over the last few decades is unsustainable. Our main fossil fuel sources—oil, coal and gas—are finite natural resources and are being depleted at a very fast pace. Amid the concern of rapidly depleting energy sources, there also exists a potent threat of climate change and environmental degradation. The vast potential of renewable energy resources in the country has a very crucial role to play. On one hand, it ensures sustainable and pro-environment growth; on the other hand it has the potential to fulfil the energy security dream of the country. Realising concerns of the conventional energy and potential of renewable energy, the government has formulated various policies to harness the available resources, largely by attracting private investments in the country.

On the adequacy of the policy drivers, incentives and mechanisms, there is a divergence of opinion among the various energy companies. One set of the survey, which accounts for around 64% of the respondents, reveals that the current policy and programme formulation need to be more attractive to make the sector investment friendly. However, another significant number of respondents, around 34%, contradict this view and believe that policy and regulatory regime is enabling and would continue to attract and harness investment in the sector.

Government's effort on policy and programme formulation in the renewable sector have been adequate to make the sector investment friendly



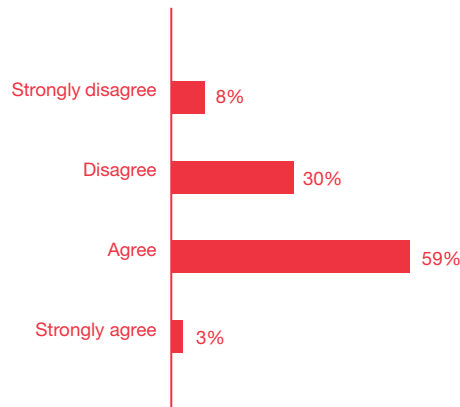
With the enunciation of specific provisions for renewable energy in the Electricity Act 2003 and announcement of the National Action Plan on Climate Change (NAPCC) and Jawaharlal Nehru National Solar Mission (JNNSM) guidelines, it is expected that the path to high investment would be paved by the renewable sector. However, the concerns relating to the implementation of the policy instruments need to be eliminated for effective exploitation of the renewable energy sources.

Investing in renewable energy technologies

The market in India for the renewable energy business is growing at an annual rate of 15%. The scope for private investment in the sector is estimated to be about 3 billion USD¹, during ensuing years. This growth is expected to continue in the years to come, as stricter environmental norms and regulatory pressure are placed on Indian industries. The government of India is encouraging foreign investors to establish renewable energy-based power generation projects on the build-own-operate (BOO) model. The Electricity Act, 2003 has mandated that the host utilities should procure renewable power from renewable power generating projects in their area of service. Such provisions promise to provide the necessary impetus for development of renewable-based power projects across the country. Other suitable measures such as providing tax holidays for power-generation projects and procurement of renewable energy power at preferential tariff rates by the utilities also promises to evince interest of investors in the renewable energy sector. State-specific measures such as providing single-window clearance to the power-generation projects ensure hassle-free investment in certain states across the country.

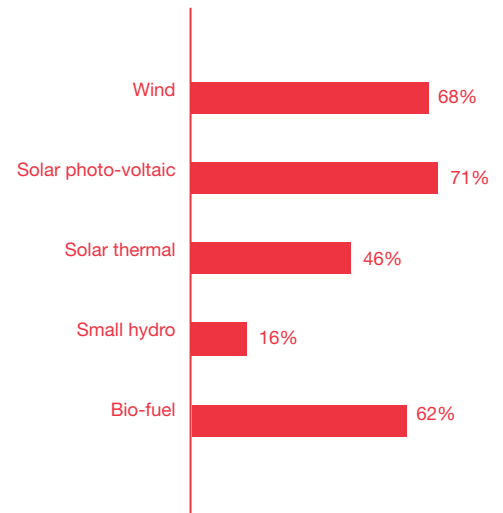
Our survey reveals that 62% of the survey respondents are of the view that investment in the renewable energy segment is favourable as various fiscal and financial supports provide comfort to investors keen on engaging in upstream business of renewable energy sector in India.

Energy companies consider investment into renewable energy technologies a feasible option



Additionally, a significant number of the respondents believe that wind, solar and bio-fuel segment has greater potential for investment over other form of renewable energy segments. Wind power technology, as such, is relatively one of the most mature renewable energy technologies in the Indian renewable energy space. Owing to its low gestation period, attractive buy back rates, provisioning of generation-based incentives (GBI), the wind sector continues to be one of the most preferred avenues for investment. Solar power based on photo-Voltaic (PV) technology is also another favoured destination for investment in the renewable energy space. Earmarking accelerated depreciation benefits, high preferential tariffs and extending five-year tax holidays for solar power generation projects has proved to be a shot in the arm for solar investment in the country. The survey also reveals that investment in power projects based on bio-fuels also suits to the taste of the oil companies.

Please indicate the renewable energy technology(ies) your company would be interested in pursuing



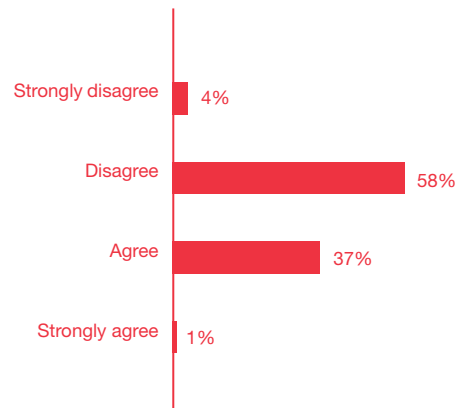
¹ Bloomberg-2010-11 and Direc 2010-MNRE

Evolving market instruments and mechanisms in renewable energy space

Although India is abundantly gifted with a variety of renewable energy sources, not all states are endowed with the same level of renewable energy sources. The Electricity Act, 2003 stimulated the development of renewable energy-based power generation by mandating the state electricity regulatory commissions (SERCs) to set targets for distribution companies to purchase certain percentage of their total power requirement from renewable energy sources. This target is termed as a renewable purchase obligation (RPO). However, the procurement of the renewable power from outside the state boundary is not permissible to fulfil RPO requirements. Therefore, a mechanism that enables and recognises the inter-state renewable energy transactions for RPO fulfilment has been devised. This mechanism has been named the renewable energy certificate (REC) mechanism and is still in the development stage.

However, our survey has revealed a mixed response with regard to efficacy of this newly devised mechanism. The survey shows that 62% of the respondents agreed with the fact that such market instruments have been less effective in boosting the development of renewable energy technologies in the country. These respondents were of the view that the REC mechanism has not taken off because an effective RPO enforcement framework is not in place, due to which obligated entities do not honour their RPO requirements. It was also widely felt that lenders find it difficult to finance renewable energy projects under the REC mechanism because there is less certainty with regard to revenue realisation from such projects.

Market instruments like renewable purchase obligations, renewable energy certificates and environmental credits, which are designed for boosting the development of renewable energy technologies have been successful in India



Key takeaways

1. Given the fact that renewable energy is an emerging sector, fostering a supportive policy and regulatory framework for its development is of paramount importance.
2. Solar, wind and bio-fuel technologies continue to be an attractive option for investment in the renewable energy sector from the oil and gas companies' perspective. Incentives and other facilitations should continue in this segment and should be extended for other emerging technologies as well.
3. Evolving market models like the RPO-REC mechanism have stimulated a new phase of development in the renewable energy sector but their effective implementation still remains a challenge. The regulator must ensure effective implementation of these mechanisms to win investor confidence in the REC business.

Research methodology

The second innings

In 2010, the first edition of the CEO Survey was launched by the Petrotech Society and Petroleum Federation of India in knowledge partnership with PwC. The survey was titled as *View from the Top – Oil & Gas Industry Survey on Global Energy Equilibrium*. The 2010 survey was conducted to solicit and analyse the views of leaders from the oil and gas industry on the theme global energy equilibrium. The survey was released in the 9th International Oil and Gas Conference and Exhibition organised by Petrotech Society along with Oil and Natural Gas Corporation (ONGC) during the period from October 31 to November 3, 2010, at New Delhi, India. Carrying on the legacy, Petroech Society commissioned PwC as a knowledge partner to conduct the second edition of the senior management survey based on the theme of Petrotech 2012. The theme of the 10th International Oil and Gas Conference and Exhibition organised by Petrotech Society along with Indian Oil Corporation Ltd (IOCL) is ‘Hydrocarbons and beyond: Changing landscape’.

The 2010 CEO Survey was appreciated by the industry and served as a platform for mobilising and presenting the views of stalwarts of the industry. The survey also served as a medium to capture the thoughts of the industry leaders on the theme of the conference which helps the conference participants to contextualise various sessions proposed to be held in the conference. This year’s theme for the conference is apt since India in its quest for energy security is looking at options within and beyond hydrocarbons. This is a quest that has the potential to change the energy landscape of India. All this within the overall constraints of maintaining a fine balance between ensuring growth and protecting the environment.

With that background, it is important to understand the views of the top executives of the industry. How do they foresee the energy landscape to change for India in the decades to come? What role would technology play in shaping this landscape? How would the oil and gas industry respond to the challenge of environment protection and health and safety of its workforce? Most importantly, how would the government facilitate the change in the country’s energy landscape and what will be the impact of its policies on the industry?

Survey components

The survey was conducted under eight different sections, which are essentially sub-themes being organised under Petrotech 2012. In all 44 questions were arranged and administered under the eight sections. The questions were designed to understand the view of the industry leaders on key challenges and opportunities of the following sections.

1. Growing demand for energy in India
2. Securing energy through global co-operation
3. Shale gas prospects and challenges in India
4. Innovation as a game changer for India’s energy sector
5. Future of petroleum refining: Challenges and opportunities
6. Moving towards a gas era
7. Environment, health and safety
8. Renewable energy

Survey design

The questionnaire was circulated to CEOs, directors on the board, and executive directors in the line of succession in oil and gas and associated companies. The companies included those in upstream, refining and marketing, gas, LNG, engineering and construction, services and pipelines. Responses were received from the executives of public, private and international oil and gas companies of varying size, portfolios and geographies. Care was taken to ensure no bias is introduced during the analysis of survey responses by not categorising responses under the size of the company, its geography of operations (onshore/offshore), whether it is a national or international company, or its (operations upstream/downstream/midstream). The respondents’ names and their company’s details are kept confidential for further analysis to preserve the perfect random selection required in a survey.

Survey methodology

Each of the section was analysed individually for all the responses received from the industry. The number of responses for every subject of discussion were counted and tabulated. Likewise, all questions were analysed and the responses were depicted graphically. The number of respondents under each of the points gives an indication of the industry view on the particular subject under discussion. This analysis also provides key takeaways and the list of to-do in India’s hydrocarbon industry.

Hydrocarbon and beyond

The global energy landscape is changing rapidly and India is no exception to this change. Countries are moving from exporters to importers, and importers to exporters. For some countries the challenge of securing energy supplies is growing. The latter countries are running an extra mile to secure their future and infusing diplomatic activity to secure energy resources. In tandem, the environmental concern is also forcing continuous action to increase the size of renewable in the energy pie, which in turn is throwing open challenges in supply and distribution infrastructure. Sustainable energy availability is a major global agenda now.

The global economic slowdown over the last few years has made the Indian policy makers relook at the targeted GDP growth rates. The under-recoveries of the oil marketing companies are rising by the day and the fluctuations in the global crude oil prices aren't helping anyone. Drastic measures are needed, and needed fast to prevent the financial crippling of the downstream sector. While renewable energy is being viewed by many as the next thing which will displace fossil fuels in future, hydrocarbons and coal consumption will continue to form the lion's share of the Indian energy consumption basket. This interplay will play a major role in shaping the future strategies of entire energy ecosystem in India. Apart from growth of renewable energy technologies, unconventional hydrocarbon sources like shale gas and CBM are gaining a lot of attention. Natural gas, the fastest growing hydrocarbon energy source is making the hydrocarbons industry sit back and have a re-look at its long term growth strategy.

Environmental impact of excessive usage of fossil fuels is a global concern that has drawn the attention of global leaders. This has led to formulation of stricter emission norms and countries around the world adhering to them. Adherence to the norms comes with a cost and the developing and the developed world are still divided on who bears the cost. The divide is so big that it is threatening to breakdown the good work done till date.

Technological innovation and up-gradation are the need of the hour. Research and development is now being viewed as investment rather than spend. Change is the only constant and this is being realised by all stakeholders in the hydrocarbon space. Technology is the aid to exploit the difficult to access energy sources.

Continuing with effort of Petrotech Society to be a catalyst in the development of hydrocarbon sector, the Society takes feedback on the country's hydrocarbon sector performance and seeks suggestions on way forward from the captains of industry. Yet again this year, in knowledge partnership with PwC, a survey of views of senior industry professionals on performance and future of the energy industry has just been taken before Petrotech 2012.

Keeping in view the challenges, the megatrends were identified that will shape the future of the Indian oil and gas industry in the next 20–25 years. The industry captains were asked to provide insights on how the industry can prepare itself for this future which is 'hydrocarbons and beyond'. The megatrends were posed in the form of statements and the leaders in energy companies were asked to present their agreement or disagreement to the statements. The statements of the administered survey were developed around the theme "Hydrocarbon and beyond: Changing landscape". The remaining sections present the views of the industry captains on these statements. This, in turn allowed analysing the way they perceive these identified megatrends and how they perceive the landscape to change beyond hydrocarbons.

This publication sets out the views received from the survey participants, analyzes the responses for the view emerging, and provides further analysis on each of the topics for setting the background and action forward. In the context of changing landscapes of hydrocarbon industry, it is believed that the publication would provide a concrete agenda developed by bringing together views of experienced industry professionals.

The publication provides independent views of industry professionals and not of Petrotech Society.

Abbreviations

BPCL	Bharat Petroleum Corporation Limited
BPRL	Bharat Petro Resources Limited
BOO	Build Own Operate
CBM	Coal Bed Methane
CEA	Central Electricity Authority
CEO	Chief Executive Officer
CGD	City Gas Distribution
DGH	Directorate General of Hydrocarbons
EIA	Energy Impact Assessment
E&P	Exploration and Production
FSU	Floating Storage Unit
FSRU	Floating Storage Re-gasification Unit
GAIL	GAIL India Limited
GBI	Generation Based Incentive
GDP	Gross Domestic Product
GRM	Gross Refining Margin
GSPC	Gujarat State Petroleum Corporation
GST	Goods and Service Tax
ILO	International Labour Organization
IOC	International Oil Companies
IOCL	Indian Oil Corporation Limited
JNNSM	Jawaharlal Nehru National Solar Mission
KG	Krishna-Godavari
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas

MMSCMD	Million standard cubic metres per day
MNRE	Ministry of New and Renewable Energy
MoEF	Ministry of Environment and Forests
NAPCC	National Action Plan on Climate Change
NELP	New Exploration Licensing Policy
NOC	National Oil Company
OIL	Oil India Limited
OMC	Oil Marketing Company
ONGC	Oil and Natural Gas Corporation Limited
PCPIR	Petroleum, Chemicals and Petrochemicals Investment Region
PEL	Petroleum Exploration Licence
PNGRB	Petroleum and Natural Gas Regulatory Board
PSC	Production Sharing Contract
PSU	Public Sector Undertaking
PV	Photo-Voltaic
PwC	PricewaterhouseCoopers Private Limited
REC	Renewable Energy Certificate
RPO	Renewable Purchase Obligation
RIL	Reliance Industries Limited
R&D	Research and Development
SEEA	System of Integrated Environmental and Economic Accounting
SERC	State Electricity Regulatory Commission
UID	Unique identification
UN	United Nations
US/ USA	United States of America
USA	United States of America
USD	United States Dollars

About Petrotech Society

Taking note of the advances in technological innovations across the oil and gas value chain, from well to wheel, for the country to become self reliant, a group of the technocrats thought it wise to create a forum through which work and experiences of companies engaged in hydrocarbon value chain could be shared. Hence, in 1999 PETROTECH was registered under the Societies Registration Act, 1860. PETROTECH is an International platform for scientists, technologists, planners and policy makers, management experts and entrepreneurs in oil & gas industry to exchange their views and share their knowledge, expertise and experience and to solicit views for achieving global energy security. It helps in identifying and exploring new areas of cooperation and technology transfer for harnessing the petroleum resources of the world for the benefit of mankind. It organizes meetings, seminars, workshops, conferences, brainstorming sessions, exhibitions and other programmes at national and international level in India and abroad.

Its objectives also include promotion of R&D and development of trained, experienced and motivated manpower for exploration of oil & gas and its downstream processing activities. PETROTECH is a bridge between industry and academia bringing both closer through regular interactions. PETROTECH publishes books, CEOs' survey, proceedings, magazines, brochures, newsletters and other literatures in the field of hydrocarbons and related policies.

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This survey is published by Petrotech Society with PwC as knowledge partner on the occasion of Petrotech 2012, latest in the series of Conference & Exhibition events held in India that provide context around issues affecting the technology in oil and gas sector

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